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NATIONAL BUREAU OF STANDARDS REPORT

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PROGRESS REPORT

WATER-VAPOR TRANSMISSION IN REFRIGERATED WAREHOUSES

January 1 to March 31, 1953

by

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for

Office of The Quartermaster General

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Progress Report

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Construction of the apparatus and installation of the instrumentation and wiring was completed. Calibration of the apparatus and operational tests of the component parts were started.

Operational tests were made on the refrigeration system. It was desired to operate the cold side as low as -20 deg F maintaining a minimum temperature difference between the air and coil surface to prevent condensation of moisture within the box. A plot of relative humidity versus maximum allowable temperature difference between the air and coldest surface to prevent condensation was prepared for a range of air temperatures from -20 deg F to 70 deg F. This plot shows at 70% relative humidity and -20 deg F dry bulb, the maximum allowable temperature difference to prevent condensation would be 6 deg F.

Preliminary refrigeration system tests showed that water in the refrigerant system was causing the expansion valves to freeze up. The water was removed with suitable dryers. Further tests showed a need for increasing the

the capacity of the unit and that modification of the system was needed to provide a suitable temperature distribution. The capacity of the unit was increased by installing a larger motor and pulley and a uniform temperature distribution was achieved by providing heat on the bulb of the expansion valve and operating the refrigerating coil flooded.

A plenum was built around the coil and the temperature drop across the coil measured. These measurements indicated air movement at the rate of 800 CFM would be necessary to maintain the desired small temperature difference between the air and coil.

The static pressure on the plenum was measured with air movement at 800 CFM. A special test setup was constructed to measure various fans to select one that would move the required CFM of air against the measured static pressure for the least power input. Several fans and blowers were tested and one selected and installed in a manner to give a uniform air velocity through the coil. Satisfactory data was then obtained on the cold side.

Based on the previous tests, a similar arrangement was designed for the desiccant box to give separate refrigeration control and proper temperature distribution. Orders have been placed and installation will start upon delivery of materials.

A heat calibration for the warm side of the apparatus was started. Capillary tubes were installed between the warm box and the room and between the cold box and the room. The purpose of these capillary tubes is to equalize the pressure on each side of the test panel with the room pressure and also to admit air for a pressure test of the seals of the apparatus before each test. These tubes will be closed when steady temperatures are achieved on each side of the test panel. A test panel for calibration purposes was constructed from 2x4 framing and fully insulated with fiberglass insulation. Each face of the test panel was covered with 1/16 inch aluminum sheet as a vapor seal. The construction of this panel is similar to that of the walls of the apparatus. The test panel was installed and air pressure applied to the warm side. Some small leaks were indicated and will be corrected before water-vapor transmission tests are started. The heat calibration tests are now in progress.

A small oven was designed for the regeneration of the silica gel desiccant at the end of each test.

The design of a test panel for simultaneous transmission of heat and water-vapor was started.

A series of operational and calibration tests for the following purposes has been started.

1. Heat calibration of warm side
    a. 20 deg F below room temperature
    b. At room temperature
    c. 20 deg F above room temperature with humidity controlled at 50%
2. Vapor tightness test of complete apparatus
3. Operational test of humidifier, dehumidifier and their respective cantilever weighing device.
4. Simultaneous heat and water-vapor transmission test of a panel of known characteristics.

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